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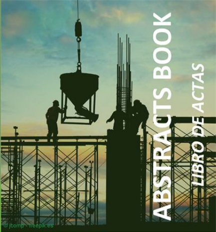

ABSTRACTS BOOK

LIBRO DE ACTAS

VII International conference on Technological Innovation in Building

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COMPARATIVE ANALYSIS OF THE SHEAR BEHAVIOUR OF GLULAM TIMBER

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Abstract

Timber construction is on the rise, but the regulations for sound insulation, vibration, and deflection are often an expensive obstacle for timber slabs. The use of timber combined with other construction materials can address the design challenges for timber structures. Timber-concrete composite (TCC) slabs are an alternative. They offer a range of advantages over timber slabs such as higher stiffness and load-bearing capacity; better sound insulation and vibration behaviour; and improved fire resistance. TCC slabs also have advantages over reinforced concrete slabs. These include lower CO2-emissions, lighter weight, fast and dry construction processes, as well as a high degree of prefabrication.

The connection between timber and concrete is the main factor on the load-bearing behaviour of the composite slab. The connection stiffness, the shear resistance, and the ductility of the connection defines the structural behaviour of the slab. A variety of connection systems can be used. Dowel-type fasteners such as screws are often used in prefabricated TCC.

Current research on TCC slabs mainly focusses on the use of normal weight concrete with spruce. Lightweight concrete (LWC) is used due to its low weight and creep coefficient. LWC in TCC elements requires an efficient shear connection between the two materials; therefore, their interaction can maximize the composite behaviour of the structural elements. However, there is a lack of knowledge regarding the interaction between LWC and timber.

In this research, a series of experimental tests were carried out on TCC samples. Three types of glued laminated timber (glulam), spruce, pine and chestnut were used with LWC to manufacture TCC slabs. Each sample consisted of a timber beam 100 mm thick and 200 mm wide, six screw connectors and an LWC slab 60 mm thick and 300 mm wide. The total length of the samples was 600 mm. The distance between the centres of the connectors in the direction of the grain was 150 mm. The samples were tested following EN 26891:1991. The load was increased by 20% of the estimated maximum load (F_{est}) per minute. After 2 minutes, 40% of the maximum load was reached and kept constant

for 30 seconds. The load was then reduced to 10% of the·F_{est} and kept constant for 30 seconds. Finally, the load was again increased up to the maximum load or until a relative displacement of 15 mm was achieved.

The ultimate shear force and slip modulus were measured and compared. Based on the tests, the shear bearing capacity using chestnut and pine (which are from indigenous trees) increased 43.7% and 28% respectively over that of spruce (imported from northern Europe). The type of timber has a great effect on the shear behaviour of TCC. In addition, the slip modulus is 129.8, 162.7, 170.9 kN/mm for spruce, pine and chestnut, respectively. As a result of this research, it can be concluded that the mechanical shear behaviour and slip modulus of TCC slabs fabricated with pine and chestnut are better than those made with spruce.

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